Case Report Rapport de cas

Squamous cell carcinoma causing dorsal atlantoaxial spinal cord compression in a dog

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Abstract — A 12-year-old Chihuahua dog was presented for cervical pain and progressive tetraparesis. Magnetic resonance imaging revealed spinal cord compression due to a mass in the dorsal atlantoaxial region. Surgical treatment was performed. The mass was histopathologically diagnosed as a squamous cell carcinoma. The dog recovered to normal neurologic status after surgery.

Résumé — Carcinome squameux causant une compression de la moelle épinière altantoaxiale dorsale chez un chien. Un Chihuahua âgé de 12 ans a été présenté pour de la douleur cervicale et une tétraparésie progressive. Une imagerie par résonance magnétique a révélé une compression de la moelle épinière en raison d'une masse dans la région atlantoaxiale dorsale. Le traitement chirurgical a été réalisé. La masse a été diagnostiquée à l'histopathologie comme étant un carcinome squameux. Le chien a retrouvé une condition neurologique normale après l'opération.

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Canine squamous cell carcinoma (SCC) is a malignant neoplasm. The skin, oral cavity, and digits are the most common sites of SCC in dogs (1), and other locations reported include the lung, esophagus, larynx, prostate, bladder, penis, and anal sac (2–4). Oral SCC can be arbitrarily classified into the tonsillar SCC characterized as locally invasive with high metastatic potential and the non-tonsillar SCC characterized as slowly progressive with a low metastatic rate (5–7). Bone lysis and metastasis are very common in digital SCC (8–10). Thus, canine SCC is characterized by occurrence at various anatomical sites and showing varied biological behavior. However, to our knowledge, there is only 1 report of spinal SCC metastasizing to the thoracic and lumbar vertebrae (11), and there are no previous reports of SCC with cervical vertebral invasion. In this report, we describe the clinical signs, neurological findings, imaging findings, surgical approach, and outcome in a dog with SCC that had cervical vertebral invasion and subsequent spinal cord compression.

Case description

A 12-year-old, spayed female, Chihuahua dog weighing 2.4 kg was presented with a 10-day history of cervical pain and progressive tetraparesis. On admission, the dog was bright and alert, but was in pain and reluctant to move. There were no palpable cutaneous or digital masses. Palpable lymph nodes appeared normal in size and texture. Oral examination detected no mass lesions or swelling of the tonsils. Neurological examination revealed the dog to be ambulatory with moderate tetraparesis and severe ataxia. The cranial nerve examination findings were unremarkable. Severe paraspinal pain was detected on deep cervical manipulation. In both thoracic and pelvic limbs, the postural reactions were decreased and the spinal reflexes were normal, suggestive of a C1–C5 myelopathy. The differential diagnoses included intervertebral disc disease, neoplasia, meningomyelitis, and fracture/luxation. Cervical radiographs showed a mass lesion dorsal to C1–C3, with bone lysis of the spinous process of the axis (Figure 1). Radiographs of the cranium, thorax and abdomen were unremarkable. Abdominal ultrasonography revealed no abnormal findings. Complete blood (cell) count (CBC) and serum biochemical panel were within normal limits. A computed tomography (CT) scan was performed using a 16-slice helical CT scanner (Brightspeed Elite; GE Healthcare, Milwaukee, Wisconsin, USA). The scanning parameters were as follows: slice thickness, 6.25 mm; reconstruction interval, 6.25 mm; helical pitch, 1.0; X-ray tube potential, 120 kV; X-ray tube current, 260 mA. Magnetic resonance imaging (MRI) was also performed using a 0.4 Tesla scanner (Aperto Inspire; Hitachi Medical, Tokyo Japan). T2-weighted images were acquired using a fast spin-echo (FSE) sequence at a repetition time (TR) of 2000 to 2500 ms, and an echo time (TE) of 112 to 120 ms. T1-weighted SE images were acquired at a TR of 405–406 ms and a TE of 13 ms before and after administration of 0.2 mL/kg body weight gadodiamide (Omniscan intravenous injection; Daiichi-Sankyo, Tokyo, Japan). The slice thickness was 3.0 to 3.5 mm. The images were acquired in sagittal and transverse

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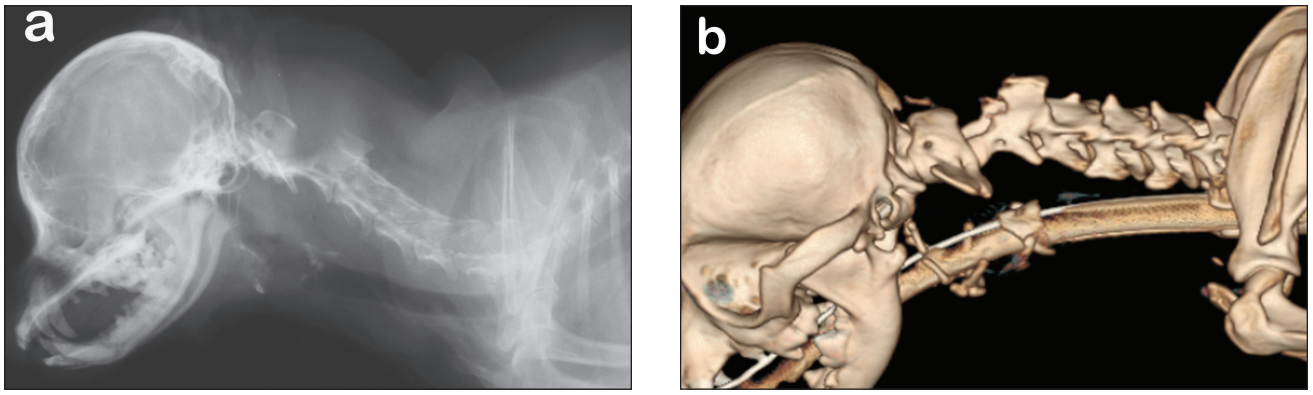

Figure 1. Pre-surgical cervical radiograph (a) and computed tomography (b) images. Bone lysis of the spinous process of the axis is apparent.

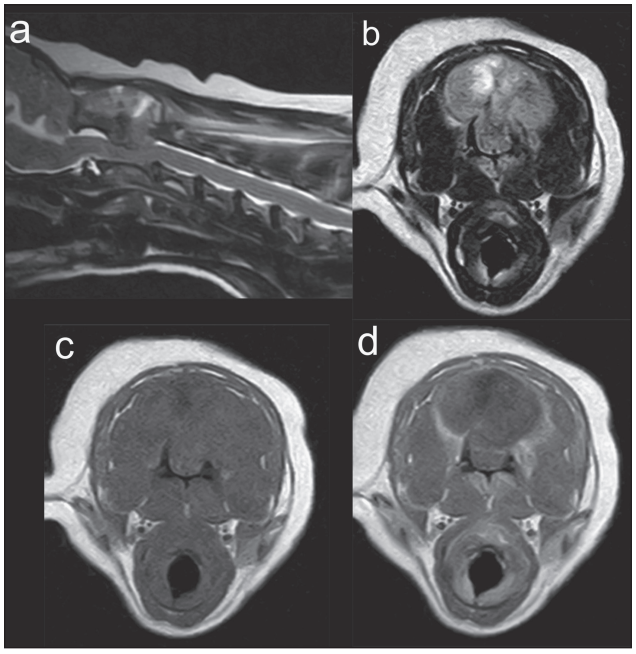

Figure 2. Sagittal (a), transverse (b) T2-weighted (T2W) and transverse T1-weighted (T1W) (c), and postcontrast (d) magnetic resonance images. A mass lesion is visualized arising from the dorsal atlantoaxial region causing dorso-lateral compression of the spinal cord. The lesion was iso- to hyper-intense on T2W images, iso-intense on T1W images and demonstrated contrast enhancement at the marginal regions of the mass.

planes. Computed tomography and MRI revealed a mass lesion dorsal to the atlantoaxial spine causing severe extradural spinal cord compression (Figure 2) and bone lysis of the dorsal lamina of the axis, thus primary vertebral tumors such as osteosarcoma, chondrosarcoma, myeloma, fibrosarcoma or metastatic tumors were suspected. On the fifth day of hospitalization, surgical resection of the mass and vertebral stabilization were performed.

The dog was placed under general anesthesia and positioned in sternal recumbency with the neck elevated. A dorsal surgical approach to the cranial cervical spine was made. The mass lesion was seen protruding between the biventer cervicis muscle and the obliquus capitis caudalis muscle. An *en bloc* excision of the mass with a 1-cm lateral margin including vertebral arches of the atlas, axis, and cranial part of the C3 was attempted, but complete excision was impossible because the mass migrated into the epidural space causing substantial adhesion to the dura mater. Dorso-lateral stabilization of the C1–C2 was performed bilaterally using positively threaded profile pins (Acrylic fixation pin; IMEX Veterinary, Longview, Texas, USA) and polymethylmethacrylate (Simplex P Bone Cement; Stryker Corporation, Kalamazoo, Michigan, USA) (Figure 3). Histopathologically, the tumor was composed of islands, cords, and trabeculae of neoplastic epithelial cells showing variable degrees of squamous differentiation towards the center of each focus. Tumor cells had abundant eosinophilic cytoplasm and ovoid nuclei with a single prominent nucleolus. These findings are characteristic of SCC (Figure 4). The tumor showed marked invasiveness and infiltration into the bone tissue and the boundary between tumor and normal tissues was unclear. No continuity of the skin and tumor was observed.

After surgery, the cervical pain was relieved. The ambulation was improved with slight ataxia and mild tetraparesis; the dog was discharged 5 d after surgery. The owner declined any adjuvant therapies. At suture removal 16 d after surgery, the dog was ambulatory with no evidence of cervical pain, and had neither ataxia nor proprioceptive deficits. A telephone interview with the owner revealed that the dog became nonambulatory several days after suture removal and died at home 32 d after surgery. Because no postmortem examination was performed, the cause of death was not determined.

Discussion

Canine SCC has been reported to occur at various anatomical sites (1), with different biological behaviors. In the present case, the mass lesion dorsal to the atlantoaxial spine causing spinal cord compression showed no continuity with the skin. Preoperative staging included a CBC, biochemical profile, exploration of the oral cavity, thoracic and abdominal radiographs, abdominal ultrasonography. Cervical CT and MRI were performed, but no primary or other metastatic lesions were detected.

Almost any carcinoma, other than SCC, can readily metastasize to bone (12–15). The lumbar vertebrae, femur, humerus, rib, and pelvis are common sites for metastasis, possibly because

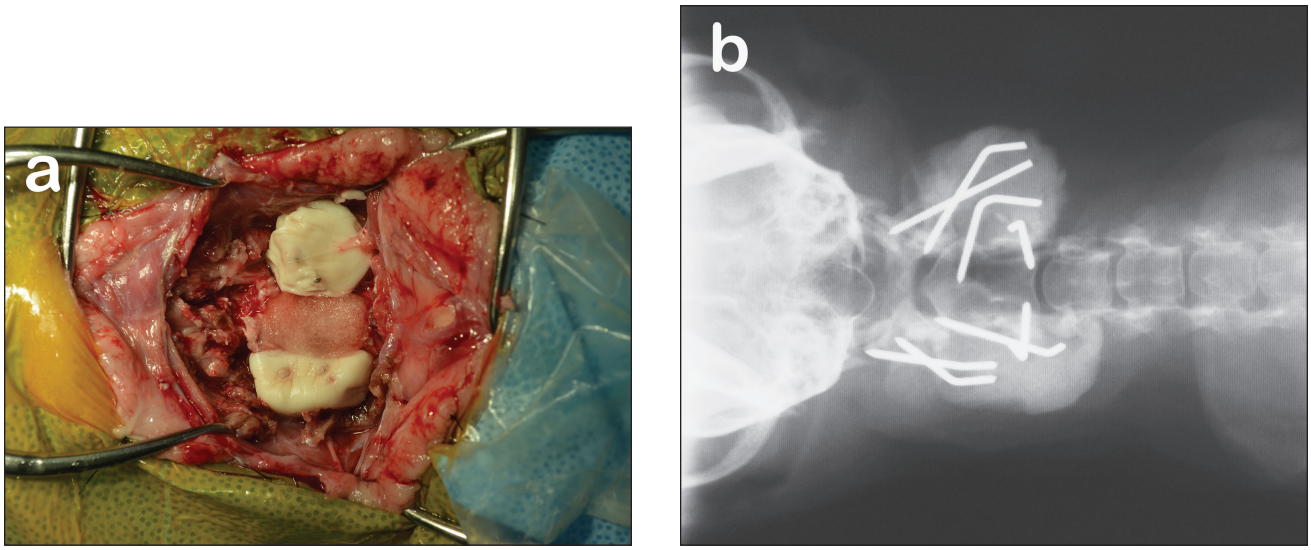

Figure 3. Intra-operative image (a) of dorso-lateral stabilization of C1–C2 and post-surgical radiograph of the implant (b). Four positively threaded profile pins were inserted into the left and right bodies of C1 and C2, respectively, in order to provide stability. Cefazolin powder was mixed with a half dose of the polymethylmethacrylate powder before mixing with the liquid. Copious saline flush was used to minimize thermal injury to the spinal cord and to the adjacent tissue during polymethylmethacrylate polymerization. The pins were incorporated into polymethylmethacrylate to achieve bilateral dorso-lateral stabilization of C1–C2.

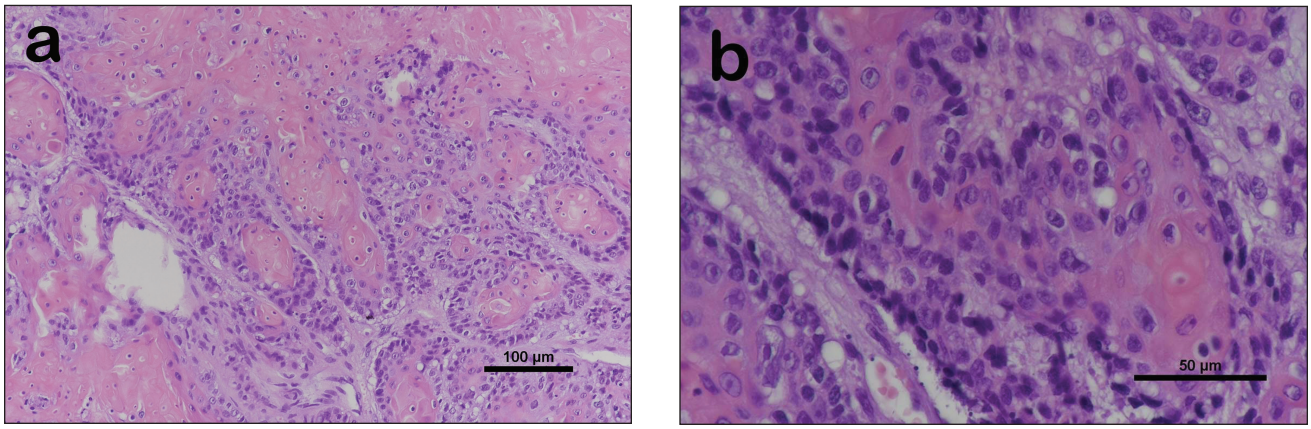

Figure 4. Photomicrographs of the excised mass. a – Multiple foci of keratinized cells are recognized. b – Magnified view. The tumor was composed of islands, cords, and trabeculae of neoplastic epithelial cells showing variable degrees of squamous differentiation towards the center of each focus. Tumor cells had abundant eosinophilic cytoplasm and ovoid nuclei with a single prominent nucleolus. These findings are characteristic of squamous cell carcinoma (hematoxylin and eosin stain).

these are predilection sites for bone metastasis from the common urinogenital malignancies, such as mammary, prostate, and bladder cancer (14).

By contrast, reports of SCC causing bone metastasis in dogs are limited (11,16,17). There have been reports of tonsillar, skin, and gingival SCC that have metastasized to the distal humerus (16), thoracic and lumbar vertebrae (11), and multiple ribs (17), respectively. Oral SCC frequently invades bone, especially to the maxilla and mandible (18). However, SCC causing distant metastases to the vertebrae is rare (11). There have been only a few reports of SCC that metastasize to the vertebrae in humans (19–21). In these cases, primary SCC sites were the tongue, gingiva, and retromolar, and metastatic lesions were identified in the lumbar, cervical to lumbar, and cervical to thoracic vertebrae, respectively.

In dogs, there is only 1 report describing SCC of the skin over the right scapular-humeral joint with metastases to the thoracic and lumbar vertebrae and subsequent spinal cord compression (16). Cooley et al (13) reported on 19 dogs with skeletal carcinoma, in which skeletal metastasis was the initial clinical manifestation of neoplastic disease. Of these 19 dogs, only 1 had a lesion in the cervical spine but the primary tumor was unknown. Similar to the present case, neurological dysfunction secondary to metastatic carcinoma was the initial clinical manifestation. Skeletal metastasis representing the initial clinical manifestation prior to a diagnosis of carcinoma of unknown origin is recognized in humans, and accounts for 3% to 4% of metastatic carcinomas (22–26). These reports highlight the potential difficulty in identifying the origin of the tumor, despite an extensive diagnostic workup. It should be noted that although

oral exploration revealed no mass lesions of the oral cavity or tonsils, we could not rule out the possibility that there was a primary tumor in these sites.

The aim of surgery was to excise the mass with clean margins, to decompress the spinal cord, and to stabilize the atlantoaxial joint if needed. However, complete mass excision was impossible because of invasion of the mass into the epidural space. A dorsal approach to the atlantoaxial joint has been reported (27,28). A disadvantage of this technique is that fusion of the atlantoaxial joint cannot be achieved because the articular surfaces remain intact (28). Furthermore, transarticular pins cannot be inserted. Because of these limitations when stabilizing the atlantoaxial joint from a dorsal approach, we increased the number of pins inserted into the vertebral bodies. Palliative treatment options included the use of opioid, non-steroidal anti-inflammatory drugs (13), bisphosphonates (29), or palliative fractionated radiotherapy (30). In the present case, palliative fractionated radiotherapy was declined by the owner.

This report describes the clinical signs, neurological findings, imaging findings, surgical approach and outcome in a dog with cervical pain and tetraparesis as the initial clinical manifestation caused by SCC. We could not determine whether this was an atypical location of a solitary primary SCC lesion or a metastatic lesion from an unidentified SCC. It should be noted that the staging was incomplete, and no postmortem examination was performed. In patients with a suspected skeletal neoplastic lesion, it is important that a thorough physical examination, detailed imaging and complete staging be performed. Retrospectively, fine-needle aspiration of a regional lymph node might have been warranted, even though there was no palpable regional lymphadenopathy. In this case, the dog showed postoperative neurologic recovery, but the long-term prognosis was poor.

To our knowledge, this is the first case of SCC causing cervical vertebral invasion and subsequent spinal cord compression in a dog; this may be considered as an uncommon differential diagnosis for dogs with cervical myelopathy.

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